

We claim:

1. An electrolysis cell comprising an anode compartment which comprises an aqueous solution of at least one alkali metal salt, a cathode compartment and a solid electrolyte which separates the anode compartment and the cathode compartment from one another, wherein that part of the surface of the solid electrolyte which is in contact with the anode compartment and/or that part of the surface of the solid electrolyte which is in contact with the cathode compartment has/have at least one further ion-containing layer.

2. An electrolysis cell as claimed in claim 1, wherein

- (a) the at least one alkali metal salt is a lithium salt or a mixture made from two or more of these, and the solid electrolyte has been selected from the group consisting of lithium- β -aluminum oxide, lithium- β'' -aluminum oxide, lithium- β/β'' -aluminum oxide, lithium analogs of NASICON ceramics, LISICONs and Li-ion conductors with perovskite structure, or
- (b) the at least one alkali metal salt is a sodium salt or a mixture made from two or more of these, and the solid electrolyte has been selected from the group consisting of sodium- β -aluminum oxide, sodium- β'' -aluminum oxide, sodium- β/β'' -aluminum oxide, and NASICON ceramics, or
- (c) the at least one alkali metal salt is a potassium salt or a mixture made from two or more of these, and the solid electrolyte has been selected from the group consisting of potassium- β -aluminum oxide, potassium- β'' -aluminum oxide, potassium- β/β'' -aluminum oxide and potassium analogs of NASICON ceramics.

3. An electrolysis cell as claimed in claim 1 or 2, wherein the at least one ion-conducting layer which relates to that surface of the solid electrolyte which is in contact with the anode compartment is a polymer electrolyte, a ceramic electrolyte, a compound which intercalates the alkali metal ions of the at least one alkali metal salt as claimed in claim 1, or a mixture made from two or more of these.

4. An electrolysis cell as claimed in any one of claims 1 to 3, wherein the at least one ion-conducting layer which relates to that surface of the solid electrolyte which is in contact with the cathode compartment is an alkali metal salt, where the alkali metal is identical with that of the alkali metal salt as claimed in claim 1, a compound which intercalates the alkali metal ions of the at least one alkali metal salt as claimed in claim 1, or a mixture made from two or more of these.

5. An electrolysis cell as claimed in claim 4, wherein

(a) the at least one alkali metal salt as claimed in claim 1 is a lithium salt or a mixture made from two or more of these, and

5 (aa) the alkali metal salt which relates to that surface of the solid electrolyte which is in contact with the cathode compartment has been selected from the group consisting of LiOH, LiNH₂, LiCl, LiBr, LiI, LiOR and a mixture made from two or more of these,

10 (bb) the compound which intercalates lithium ions is graphite, C₆Li or a mixture of these, or

(b) the at least one alkali metal salt as claimed in claim 1 is a sodium salt or a mixture made from two or more of these, and

15 (aa) the alkali metal salt which relates to that surface of the solid electrolyte which is in contact with the cathode compartment has been selected from the group consisting of NaOH, NaNH₂, NaCl, NaBr, NaI, NaOR and a mixture made from two or more of these,

(bb) the compound which intercalates sodium ions is graphite, C₈Na or a mixture of these, or

20 (c) the at least one alkali metal salt as claimed in claim 1 is a potassium salt or a mixture made from two or more of these, and

(aa) the alkali metal salt which relates to that surface of the solid electrolyte which is in contact with the cathode compartment has been selected from the group consisting of KOH, KNH₂, KCl, KBr, KI, KOR and a mixture made from two or more of these,

25 (bb) the compound which intercalates potassium ions is graphite, C₈K or a mixture of these,

where R is straight-chain or branched-chain alkyl having from 1 to 5 carbon atoms.

6. An electrolysis cell as claimed in any one of claims 1 to 5, wherein

30 (a) the at least one alkali metal salt as claimed in claim 1 is a lithium salt or a mixture made from two or more of these, and the cathode is composed of lithium, or

(b) the at least one alkali metal salt as claimed in claim 1 is a sodium salt or a mixture made from two or more of these, and the cathode is composed of sodium, or

35 (c) the at least one alkali metal salt as claimed in claim 1 is a potassium salt or a mixture made from two or more of these and the cathode is composed of potassium.

7. An electrolysis cell as claimed in any one of claims 1 to 6, wherein the cathode is a steel cathode and is separated from the solid electrolyte by a liquid electrolyte, preferably an electrolyte melt.

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8. An electrolysis cell as claimed in claim 7, wherein

(a) the at least one alkali metal salt as claimed in claim 1 is a lithium salt or a mixture made from two or more of these, and the electrolyte melt is an LiOH melt, or

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(b) the at least one alkali metal salt as claimed in claim 1 is a sodium salt or a mixture made from two or more of these and the electrolyte melt has been selected from the group consisting of an NaOH melt, an NaNH₂ melt and a mixture of these, or

(c) the at least one alkali metal salt as claimed in claim 1 is a potassium salt or a mixture made from two or more of these and the electrolyte melt has been selected from the group consisting of a KOH melt, a KNH₂ melt and a mixture of these.

9. A process for preparing an alkali metal from an aqueous solution comprising at least one salt of this alkali metal, using an electrolysis cell as claimed in any one of claims 1 to 8.

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10. A process as claimed in claim 9, wherein the aqueous solution of the at least one alkali metal salt is obtained from alkali metal waste.

25 11. A process as claimed in claim 9, wherein an aqueous solution of a lithium salt is obtained from lithium waste.

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